

What is Claimed is:

1 1. A grid-connected power system having a back-up power source,
2 comprising
3 a DC/AC inverter providing an alternating current output compatible with the
4 alternating current of a utility grid, said DC/AC inverter being electrically connected with
5 the utility grid to supply said output to the utility grid when power from the utility grid is
6 available to power a load, being disconnected from the utility grid when power from the
7 utility grid is unavailable to power the load, and being electrically connected with a
8 selected portion of the load to supply said output to the selected portion of the load
9 when power from the utility grid is unavailable to power the load;
10 a primary power source providing a direct current output having a first voltage
11 supplied as input to said DC/AC inverter;
12 a back-up power source providing a direct current output having a second
13 voltage, different than said first voltage; and
14 a DC/DC converter for receiving said output of said back-up power source when
15 said DC/AC inverter is electrically connected with the selected portion of the load, said
16 DC/DC converter converting the voltage of said output of said back-up power source
17 from said second voltage to said first voltage to provide a direct current output having
18 said first voltage supplied from said DC/DC converter to said DC/AC inverter as needed
19 to power the selected portion of the load

1 2. The grid-connected power system recited in claim 1 wherein said first
2 voltage is greater than said second voltage.

1 3. The grid-connected power system recited in claim 2 wherein said first
2 voltage is in the range of 200 to 600VDC nominal and said second voltage is 96VDC
3 nominal.

1 4. The grid-connected power system recited in claim 1 wherein said primary
2 power source comprises a photovoltaic (PV) array.

1 5. The grid-connected power system recited in claim 1 wherein said back-up
2 power source comprises a battery.

1 6. The grid-connected power system recited in claim 5 wherein said primary
2 power source comprises a photovoltaic (PV) array.

1 7. The grid-connected power system recited in claim 1 and further
2 comprising a transfer unit electrically connecting said DC/AC inverter with the utility grid
3 when power from the utility grid is available to power the load, automatically
4 disconnecting said DC/AC inverter from the utility grid when power from the utility grid is
5 unavailable to power the load, and automatically connecting said DC/AC inverter with
6 the selected portion of the load when power from the utility grid is unavailable to power
7 the load.

1 8. The grid-connected power system recited in claim 1 wherein said back-up
2 power source is powered by said primary power source.

1 9. The grid-connected power system recited in claim 1 wherein said back-up
2 power source is powered by the utility grid.

1 10. The grid-connected power system recited in claim 1 wherein said back-up
2 power source and said DC/DC converter form an add-on module.

1 11. A grid-connected power system having a back-up power source,
2 comprising

3 a DC/AC inverter providing an alternating current output compatible with the
4 alternating current of a utility grid, said DC/AC inverter being electrically connected with
5 the utility grid to supply said output to the utility grid when power from the utility grid is
6 available to power a load, being disconnected from the utility grid when power from the
7 utility grid is unavailable to power the load, and being electrically connected with a
8 selected portion of the load to supply said output to the selected portion of the load
9 when power from the utility grid is unavailable to power the load;

10 a primary power source providing a direct current output supplied to said DC/AC
11 inverter;

12 a back-up power source charged by said primary power source, said back-up
13 power source providing a direct current output supplied to said DC/AC inverter as
14 needed to power the selected portion of the load when said DC/AC inverter is
15 electrically connected with the selected portion of the load; and

16 a DC/DC converter through which an as needed portion of said output of said
17 primary power source is supplied to said back-up power source only as needed to
18 charge said back-up power source.

1 12. The grid-connected power system recited in claim 11 wherein said output
2 of said primary power source has a first voltage, said output of said back-up power
3 source has a second voltage, different than said first voltage, said output of said back-
4 up power source is supplied to said DC/AC inverter through said DC/DC converter, said
5 DC/DC converter converting the voltage of said output of said primary power source
6 through said DC/DC converter from said first voltage to said second voltage and
7 converting the voltage of said output of said back-up power source through said DC/DC
8 converter from said second voltage to said first voltage.

1 13. The grid-connected power system recited in claim 12 wherein said second
2 voltage is less than said first voltage, said DC/DC converter decreases the voltage of
3 said output of said primary power source from said first voltage to said second voltage
4 and increases the voltage of said output of said back-up power source from said
5 second voltage to said first voltage.

1 14. The grid-connected power system recited in claim 13 wherein said primary
2 power source comprises a photovoltaic (PV) array.

1 15. The grid-connected power system recited in claim 13 wherein said
2 back-up power source comprises a battery.

1 16. The grid-connected power system recited in claim 15 wherein said
2 primary power source comprises a photovoltaic (PV) array.

1 17. A grid-connected power system having a back-up power source,
2 comprising
3 a DC/AC inverter providing an alternating current output compatible with the
4 alternating current of a utility grid, said DC/AC inverter being electrically connected with
5 the utility grid to supply said output to the utility grid when power from the utility grid is
6 available to power a load, being disconnected from the utility grid when power from the
7 utility grid is unavailable to power the load, and being electrically connected with a
8 selected portion of the load when power from the utility grid is unavailable to power the
9 load;
10 a primary power source providing a direct current output supplied to said DC/AC
11 inverter;
12 a back-up power source charged by the utility grid when power from the utility
13 grid is available to power the load, said back-up power source providing a direct current
14 output supplied to said DC/AC inverter when said DC/AC inverter is electrically
15 connected with the selected portion of the load; and
16 an AC/DC converter through which alternating current from the utility grid is
17 supplied to said back-up power source as needed to charge said back-up power
18 source, said AC/DC converter converting the alternating current of the utility grid into
19 direct current of appropriate voltage to charge said back-up power source.

1 18. The grid-connected power system recited in claim 17 wherein said AC/DC
2 converter decreases the voltage of alternating current therethrough from the utility grid.

1 19. The grid-connected power system recited in claim 17 wherein said primary

2 power source provides a direct current output having a first voltage, said back-up power
3 source provides a direct current output having a second voltage, different than said first
4 voltage, and further including a DC/DC converter through which said output of said
5 back-up power source is supplied to said DC/AC inverter, said DC/DC converter
6 converting the voltage of said output of said back-up power source through said DC/DC
7 converter from said second voltage to said first voltage.

1 20. The grid-connected power system recited in claim 19 wherein said
2 AC/DC converter decreases the voltage of alternating current therethrough from the
3 utility grid to said second voltage.

1 21. The grid-connected power system recited in claim 20 wherein said AC/DC
2 converter decreases the voltage of alternating current therethrough from the utility grid
3 from 120/240VAC nominal to 96VDC nominal, said DC/DC converter increases the
4 voltage of said output of said back-up power source from 96VDC nominal to 200 to
5 600VDC nominal, and said output of said primary power source has a voltage of 200 to
6 600VDC nominal.

1 22. The grid-connected power system recited in claim 20 wherein said primary
2 power source comprises a photovoltaic (PV) array.

1 23. The grid-connected power system recited in claim 20 wherein said back-
2 up power source comprises a battery.

1 24. The grid-connected power system recited in claim 23 wherein said primary
2 power source comprises a photovoltaic (PV) array.

1 25. The grid-connected power system recited in claim 17 wherein said DC/AC
2 inverter supplies said alternating current output to said AC/DC converter as needed to
3 charge said back-up power source when power from the utility grid is unavailable to
4 power the load, said AC/DC converter converting said alternating current output of said
5 DC/AC inverter into direct current of appropriate voltage to charge said back-up power
6 source.

1 26. The grid-connected power system recited in claim 20 wherein said DC/AC
2 inverter supplies said alternating current output to said AC/DC converter as needed to
3 charge said back-up power source when power from the utility grid is unavailable to
4 power the load, said AC/DC converter decreasing the voltage of alternating current
5 therethrough from said DC/AC inverter to said second voltage.

1 27. The grid-connected power system recited in claim 26 wherein said AC/DC
2 converter decreases the voltage of alternating current therethrough from the utility grid
3 from 120/240 VAC nominal to 96 VDC nominal, said AC/DC converter decreases the
4 voltage of said alternating current output of said DC/AC inverter from 120 VAC nominal
5 to 96 VDC nominal, said DC/DC converter increases the voltage of said output of said
6 back-up power source from 96 VDC nominal to 200 to 600 VDC nominal, and said
7 output of said primary power source has a voltage of 200 to 600 VDC nominal.

1 28. A method of providing back-up power in a grid-connected power system,
2 comprising the steps of
3 providing a direct current output having a first voltage from a primary power
4 source;
5 converting the direct current output of the primary power source into alternating
6 current derived from the primary power source;
7 supplying the alternating current derived from the primary power source to a
8 utility grid when power from the utility grid is available to power an AC load;
9 providing a direct current output having a second voltage, different than the first
10 voltage, from a back-up power source;
11 converting the voltage of the direct current output of the back-up power source
12 from the second voltage to the first voltage to obtain a direct current of converted
13 voltage;
14 converting the direct current of converted voltage into alternating current derived
15 from the back-up power source; and
16 supplying the alternating current derived from the back-up power source to a
17 selected portion of the load when power from the utility grid is unavailable to power the
18 load.

1 29. The method recited in claim 28 and further including the step of supplying
2 the alternating current derived from the primary power source to the selected portion of
3 the load simultaneously with said step of supplying the alternating current derived from
4 the back-up power source to the selected portion of the load.

1 30. The method recited in claim 28 wherein said step of converting the direct
2 current output of the primary power source comprises supplying the direct current
3 output of the primary power source through a DC/AC inverter, said step of converting
4 the voltage of the direct current output of the back-up power source includes supplying
5 the direct current output of the back-up power source through a DC/DC converter and
6 said step of converting the direct current of converted voltage comprises supplying the
7 direct current of converted voltage through the DC/AC inverter.

1 31. The method recited in claim 30 and further including the steps of
2 supplying the direct current output of the primary power source through the DC/DC
3 converter as needed to charge the back-up power source and converting the voltage of
4 the direct current output of the primary power source through the DC/DC converter from
5 the first voltage to the second voltage.

1 32. The method recited in claim 31 wherein said step of converting the
2 voltage of the direct current output of the back-up power source comprises increasing
3 the voltage of the direct current output of the back-up power source from the second
4 voltage to the first voltage and said step of converting the voltage of the direct current
5 output of the primary power source includes decreasing the voltage of the direct current
6 output of the primary power source from the first voltage to the second voltage.

1 33. The method recited in claim 32 wherein said step of providing a direct
2 current output having a first voltage comprises providing the direct current having the
3 first voltage from a photovoltaic (PV) array and said step of providing a direct current

4 output having a second voltage comprises supplying the direct current having the
5 second voltage from a battery.

1 34 The method recited in claim 28 and further including the steps of
2 converting alternating current of the utility grid into direct current of appropriate voltage
3 for the back-up power source and supplying the direct current of appropriate voltage to
4 the back-up power source as needed to charge the back-up power source when power
5 from the utility grid is available to power the load.

1 35. The method recited in claim 34 wherein said step of converting
2 alternating current of the utility grid comprises supplying the alternating current of the
3 utility grid through an AC/DC converter and decreasing the voltage of the current
4 through the AC/DC converter to the second voltage.

1 36. The method recited in claim 35 and further including the steps of
2 converting the alternating current derived from the primary power source into direct
3 current of appropriate voltage for the back-up power source and supplying the direct
4 current of appropriate voltage derived from the primary power source to the back- up
5 power source as needed to charge the back-up power source when power from the
6 utility grid is unavailable to power the load.

1 37. The method recited in claim 36 wherein said step of converting alternating
2 current derived from the primary power source comprises supplying the alternating
3 current derived from the primary power source through the AC/DC converter and

4 decreasing the voltage of the current through the AC/DC converter to the second
5 voltage.

1 38. The method recited in claim 37 wherein said step of providing a direct
2 current output having a first voltage comprises providing the direct current output having
3 the first voltage from a photovoltaic (PV) array and said step of providing a direct
4 current output having a second voltage comprises providing the direct current output
5 having the second voltage from a battery.

1 39. The method recited in claim 28 and further including the steps of
2 converting the alternating current derived from the primary power source into direct
3 current of appropriate voltage for the back-up power source and supplying the direct
4 current of appropriate voltage to the back-up power source as needed to charge the
5 back-up power source when power from the utility grid is unavailable to power the load.

1 40. The method recited in claim 39 wherein said step of converting the
2 alternating current derived from the primary power source comprises supplying the
3 alternating current derived from the primary power source through an AC/DC converter
4 and decreasing the voltage of the current through the AC/DC converter to the second
5 voltage.

1 41. The method recited in claim 30 and further including the steps of
2 electrically connecting the DC/AC inverter to the utility grid when power from the utility
3 grid is available to power the load, disconnecting the DC/AC inverter from the utility grid

- 4 when power from the utility grid is unavailable to power the load, and electrically
- 5 connecting the DC/AC inverter to the selected portion of the load when power from the
- 6 utility grid is unavailable to power the load.